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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/555,447

Applicant(s)

FUJINO ET AL.

Examiner

EUGENIA WANG

Art Unit

1726

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 August 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 4 and 6 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4 and 6 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SI/22)
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____
- Paper No(s)/Mail Date: _____

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 13, 2010 has been entered.

Response to Amendment

2. In response to the amendment received August 13, 2010:
- a. Claim 8 has been canceled as per Applicant's request. Claims 1, 4 and 6 are pending.
 - b. The previous 112 rejections are maintained.
 - c. The core of the previous prior art rejection of record has been maintained, with slight changes made in light of the amendments. All changes made are made in light of the amendment.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1, 4, and 6 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

a. Claim 1 recites that the battery has "a design capacity density of 114 mAh/cm³ or more" (lines 1-2). However, the specification does not appear to teach such a design capacity density or even mention volumetric capacity. Thus such a limitation is seen to be new matter. Since claims 4 and 6 are dependent upon claim 1, they are rejected for the same reason.

b. Claim 1 recites a total thickness of the separator (porous film and non-woven fabric) being between 15.5 and 30 μ m, inclusive. However such a range is not appreciated within the original disclosure. For example, para 0044 states that the sum of the thicknesses of the non-woven fabric used as the separator and the thickness of the porous film is desirably about 15 to 30 μ m. Furthermore, none of the examples (as indicated by table 1 on p 32) appreciates a total thickness of 15.5 μ m. The claimed ranges for the thickness of the non-woven fabric, porous film, and total thickness (subgenus range) appear to be arbitrarily chosen from different examples (specific examples), wherein the ranges and examples falling within certain variables contradict with the claimed range of other variables (for example see example 2 or example 14 in table 1), wherein a broad range (generic disclosure) has been set forth. Accordingly, such claimed

ranges are seen as new matter. "New or amended claims which introduce elements or limitations which are not supported by the as-filed disclosure violate the written description requirement. See, e.g., *In re Lukach*, 442 F.2d 967, 169 USPQ 795 (CCPA 1971) (subgenus range was not supported by generic disclosure and specific example within the subgenus range); *In re Smith*, 458 F.2d 1389, 1395, 173 USPQ 679, 683 (CCPA 1972) (a subgenus is not necessarily described by a genus encompassing it and a species upon which it reads)." See MPEP §2163(I)(B). Since claims 4 and 6 are dependent upon claim 1, they are rejected for the same reason.

4. Claims 1, 4, and 6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

a. Claims 1 claims "a design capacity density of 114 mAh/cm³" feature. However, it is unsure what this design capacity density refers to. Is the capacity density theoretical, or actually obtained values? What volume is it being compared to – volume of the internal portion of the cell, the active region of the cell, the volume of the electrolyte, the volume of the anode material, the volume of the cathode material? Accordingly, such a feature is seen to be indefinite, as it is unclear as to what is truly being claimed.

b. A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and

bounds of the patent protection desired. See MPEP § 2173.05(c). Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claim 1 recites the broad recitation of having a porous film with a thickness of 0.5 to 10 μm , inclusive, and a non-woven fabric having a thickness of 15 to 25 μm , which yields a total thickness having a lower limit of 15.5 μm and an upper limit of 35 μm , and the claim also recites the fact that the total thickness has a lower limit of 15.5 μm and an upper limit of 30 μm which is the narrower statement of the range/limitation. Since claims 4 and 6 are dependent upon claim 1, they are rejected for the same reason.

Response to Arguments

5. Applicant's arguments filed August 13, 2010 have been fully considered but they are not persuasive.

Applicant argues the amended range total thickness is supported by table 1 and exemplifies it by picking the thickness of the porous film from one example and the thickness of the non-woven fabric from a separate example.

Examiner respectfully disagrees and submits that no appreciation for the lower limit of the total thickness is appreciated. Applicant's own arguments support this fact that two different examples were relied upon to construct such a limitation. Accordingly, as there is no specific appreciation for the lower limit of the total thickness within one example, the claimed lower limit of total thickness is seen to be new matter. Accordingly, such arguments are not found to be persuasive, and the rejection of record is maintained.

Furthermore, it is noted that Applicant has not addressed the 112(2) rejection with respect to a broad limitation and a narrower limitation within the same claim, so the rejection has been maintained.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1, 4, and 6, are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6287720 (Yamashita et al.) in view of US 6,576,366 (Fujiwara et al.), and US 2005/0014064 (Shi et al.), US 2003/0008212 (Akashi et al.), and US 5869208 (Miyasaka).

As to claim 1, Yamashita et al. teach a nonaqueous secondary battery with a nonaqueous electrolyte with a positive electrode comprising cathode active material, a

negative electrode comprising anode active material, and a separator disposed between the positive and negative electrodes, operatively with the electrolyte (col. 5, lines 8-23). Furthermore, Yamashita et al. exemplify a lithium ion secondary battery with a cathode active material made of a composite of a lithium oxide (col. 11, lines 7-10). An anode active material inherently has the property of absorbing and desorbing lithium. Example 6 has a separator [13B] made of polyethylene (col. 30, lines 63-66). Additionally, example 6 has a second layer of the separator that acts as a porous film [13A] made of insulating substance (filler) α -Al₂O₃ and binder polyvinylidene fluoride (PVDF), where the porous film [13A] is directly formed on the cathode active material layer [11b] (col. 29, lines 51-58; col. 30, lines 5-8). Furthermore, the weight ratio of α -Al₂O₃ to PVDF is 100/5 (col. 29, lines 63-64). Therefore, the weight percentage is:

$$\frac{wt_alumina}{total_wt} = \frac{100}{100+5} * 100\% = 95.2\%$$

Furthermore, Yamashita et al. teaches that Figs. 7(a) to (c) show with all of the structural attributes of their battery and can additionally be spirally wound to form a spirally wound unit cell (col. 16, lines 41-48). Note: Being wound in some manner

Yamashita et al. does not teach that (a) the separator comprises a non-woven fabric, (b) that the non-woven fabric has a melt-down temperature of 150°C or more, (c) the thicknesses of each individual section of the separator: 0.5 μ m to 10 μ m [13A] for the porous film layer and 15 μ m to 25 μ m for the non-woven fabric [13B], wherein the total thickness is 15.5 μ m to 30 μ m, (d) that the battery has a design capacity of 114 mAh/cm³, or (e) that the battery is cylindrical in shape

With respect to (a), Fujiwara et al. teaches a non-aqueous electrolyte secondary cell (title). In the teaching, materials of separators are disclosed including olefin polymers, such as polyethylene (as used by Yamashita et al. in example 6), and non-woven cloth (col. 9, lines 27-38). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the non-woven cloth taught by Fujiwara et al. for the separator of Yamashita et al.'s battery, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

With respect to (b), Shi et al. teaches a high melt integrity battery separator for lithium ion batteries (title). The separators are made of nonwoven flat sheets, wherein high temperature melt integrity means that the separator will sustain dimensional stability until a temperature of at least 200°C (abstract; para 0011). The motivation for providing nonwoven flat sheet separators with this characteristic is in order to better maintain dimensional stability within a battery. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to use the materials of Shi et al. (nonwoven flat sheets) in order to improve dimensional stability of the separator at higher temperatures.

With respect to (c), it is first noted that Yamashita et al. teaches a separator [13A, 13B] with a thickness between 100 nm to 100 μ m (col. 7, lines 52-55). Specifically, the composite separator thickness of example 6 (relied upon) is 25 μ m (and thus lies in the claimed range of the total thickness) (col. 31, lines 10-13). Although Yamashita et al.

does not mention the thicknesses of each individual section of the separator, 15 μm to 25 μm for the non-woven fabric [13B] and 0.5 μm to 10 μm [13A] for the porous film layer, fig. 5 show a proportion of the layers (i.e. substantially equal), which at the very least would render obvious the proportion shown. As applied to example 6, wherein the total thickness is 25 μm , each layer being 12.5 μm would be obvious (in light of the proportions shown in fig. 5), wherein 12.5 μm is seen to be close to the upper limit of the porous film thickness (10 μm as claimed) as well as the lower limit of the non-woven fabric thickness (15 μm as claimed). It has been held that when the difference between a claimed invention and the prior art is the range or value of a particular variable, then a prima facie rejection is properly established when the difference in the range or value is minor. Titanium Metals Corp. of Am. v. Banner, 778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985). Additionally, claims that differ from the prior art only by slightly different (non-overlapping) ranges are prima facie obvious without a showing that the claimed range achieves unexpected results relative to the prior art. (In re Woodruff, 16 USPQ2d 1935,1937 (Fed. Cir. 1990)).

As to (d), Akashi et al. teach of lithium secondary batteries, wherein the capacity reaches 850 mAh/cm³ (indicating that the design must be at least that high to achieve such values) (para 0150). The motivation for designing secondary batteries with high capacity is in order to make it practicable to be used in portable electronics (para 0004-0005). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to design batteries with a high capacity design

(for example such as 850 mAh/cm³) in order to make them usable in portable electronics.

As to (e), Miyasaka teach of a similar battery, wherein a wound battery is embodied, wherein a cylindrical shape is taught as well (col. 7, lines 50-64). Therefore at the very least, one of ordinary skill in the art would find that combining a wound battery and a cylindrical shaped battery would have yielded the predictable result of resulting in a battery that would operate as such (and thus shaping a secondary battery to achieve such a desired shape would be within the skill of the ordinary artisan). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to use a cylindrically shaped wound battery, as the application of such a shape to the wound assembly would have yielded the predictable result of providing an operating battery.

As to claim 4, the combination teaches the claim limitation, as Shi et al. teaches nonwoven flat sheets, which are fibers that are held together, used for separators; specific fibers are polyamides and polyimides (para 0013). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the nonwoven flat sheets of Shi et al. as the separator for a battery, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

As to claim 6, Yamashita et al. teaches different binders. Examples include PVDF (as used in previously cited example 6) and acrylonitrile-butadiene (copolymer latex) (col. 7, lines 59-65).

7. Claims 1 and 4, are rejected under 35 U.S.C. 103(a) as being unpatentable over Miyasaka in view of Nakamizo et al., Shi, and Akashi.

As to claim 1, Miyasaka teaches of a lithium ion secondary battery (col. 1, lines 3-7). Miyasaka's positive electrode material is a lithium metal oxide (col. 2, lines 37-44, specific examples seen in col. 11, lines 44-52). Furthermore, the negative electrode is capable of receiving (absorbing) and releasing (desorbing) lithium ion/metal (col. 6, lines 54-58). There is a separator [10] which separates the positive electrode [8] and negative electrode [9] (col. 7, lines 54-65; fig.). Miyasaka exemplifies two types of separator material a sheet and a non-woven sheet (fabric) (col. 9, lines 62-67). Furthermore it is noted that there is a protective layer (porous film) formed on the surface of the positive electrode (col. 6, lines 59-64). First it is noted that the protective layer has small openings/voids, showing that it is porous (col. 7, lines 29-31). Specifically, it is taught that the protective layer is formed on the surface of the positive using a binder (the use of a binder constitutes an adherence) (col. 7, lines 18-21, lines 32-36; col. 12, line 58 to col. 13, line 6). Furthermore, the protective layer (porous film) is a mixture of particles of electro-insulative material (filler) with a binder (col. 7, lines 18-21). Alumina is within a list of electro-insulative materials, and is specifically used (in combination with titanium dioxide) in the example (col. 7, lines 1-10; col. 12, lines 58-63). It is taught that the electro-insulative (filler) is most preferably in the protective

layer is 90-98% by weight (a portion that is completely within the claimed range) (col. 7, lines 26-29). In the specified example of the protective, the filler material is a mixture of alumina and titanium oxide, wherein the only solid portion other than this such material is the use of CMC (0.5 wt %) and PVDF (2 wt %) (col. 12, line 58 to col. 13, line 2). Accordingly such a mixture would yield that the filler (alumina and titanium dioxide) material is in a weight percent of 97.5% (100%-0.5%-2%). Further it is noted that Miyasaka teaches of a wound battery (cylinder shape embodied), wherein there is a positive electrode [8] negative electrode [9] and a separator [10] separating them (fig.; col. 7, lines 50-65).

It is noted (a) that although Miyasaka exemplifies a non-woven sheet for a separator (col. 9, lines 64-67), such a material is not specifically used in an example, (b) that Miyasaka does not specifically mention the melt-down temperature of the separator, (c) the exact the thicknesses of each individual section of the separator: 0.5 μm to 10 μm for the porous film layer (protective layer Miyasaka) and 15 μm to 25 μm for the non-woven fabric (rendered obvious to be separator of Miyasaka, set forth below with respect to section (a)) wherein the total thickness is 15.5 μm to 30 μm ., or (d) that the battery has a design capacity of 114 mAh/cm³,

With respect to (a), it is first emphasized Miyasaka's teaching at the very least renders obvious the replacement of a non-woven, as it only exemplifies two types of separators, one of which is non-woven (col. 9, lines 62-67). Accordingly, although the separator used for the example is a polypropylene film (and not an explicit non-woven material) (col. 12, lines 29-31), Miyasaka's teaching at the very least renders obvious

the replacement of a non-woven, as it only exemplifies two types of separators, one of which is non-woven. It has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, since Miyasaka recognizes the use of both a sheet and a non-woven, at the very least, the substitution of the non-woven for the film in the example would have yielded the predictable result of acting as a separator material within the battery system. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to substitute a film separator for a non-woven separator, as Miyasaka specifically appreciates both types of separators, and wherein the substitution of one known, appreciated type (i.e. non-woven) for another known, appreciated type (i.e. film/sheet) would have yielded the predictable result of operating in the same manner.

Additionally, at this point Nakamizo et al. is also relied upon to give motivation, as to why one of ordinary skill in the art would have found to obvious to replace a polypropylene film with a non-woven of the same material. Nakamizo et al. teach that it is known to use microporous films, such as polypropylene, however, such films do not retain electrolyte well, which leads to an increase in internal resistance (para 0007). However, non-woven fabric separators (of, for example polypropylene) improve electrolyte-retaining nature (para 0008). Accordingly, the motivation to use a non-woven instead of a film electrolyte would be to improve electrolyte retention, which would in turn reduce internal resistance (para 0007-0008). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was

made to use a non-woven separator instead of a film separator (both embodied by Miyasaka), as taught by Nakamizo et al. in order to improve electrolyte retention and reduce internal resistance.

With respect to (b), Shi et al. teaches a high melt integrity battery separator for lithium ion batteries (title). It is specifically Shi mentions that a non-woven separator comprising polypropylene is known to have a dimensional stability up to 167°C (para 0007, lines 8-11). Furthermore, Shi specifically notes that higher melt integrity is desired in order to not inhibit ion flow between the cathode and anode and in order to maintain dimensional stability (para 0008; para 0011). Therefore, Shi et al. provides motivation for wanting to make the separator have as high of a melt integrity (temperature) as possible (wherein at least 200°C is desired), which includes sustaining dimensional stability and strength and for promoting ion transfer (since ion transfer would be stopped if the melt integrity was too low, thus inhibiting the battery from operating) (para 0008; para 0011). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to impart as high of a melt integrity to the separator (167°C, 200°C, and 380°C specifically noted) as possible in order to improve dimensional stability of the separator at higher temperatures and in order to keep the ions flowing (to facilitate battery operation).

With respect to (c), it is noted that Miyasaka at the very least renders obvious the claimed ranges of the porous film thickness, non-woven fabric thickness, and the total thickness. First it is noted that the protective layer (porous film) has a preferable, exemplified range of between 2-10 μm (col. 7, lines 40-41). It is noted that exemplified

range lies within the claimed range (of 0.5-10 μm). Furthermore, Miyasaka embodies the thickness of the separator (embodied to be a sheet or a non-woven sheet), which is most preferably in a range of 5-30 μm (col. 9, lines 62-65; col. 10, lines 1-3). It is noted that this specifically appreciated range overlaps the claimed range (of 15-25 μm). Accordingly, a total thickness with respect to the individual thicknesses appreciated would be 7-40 μm , which also overlaps the claimed range. As Miyasaka embodies overlapping ranges for the porous film thickness, non-woven fabric thickness, and total thickness, it would at least render obvious the claimed range in such an overlapping manner. It has been held that when the difference between a claimed invention and the prior art is the range or value of a particular variable, then a prima facie rejection is properly established when the difference in the range or value is minor. Titanium Metals Corp. of Am. v. Banner, 778 F.2d 775, 783, 227 USPQ 773, 779 (Fed. Cir. 1985). Generally, differences in ranges will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such ranges is critical. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955). In re Hoeschele, 406 F.2d 1403, 160 USPQ 809 (CCPA 1969).

As to (d), Akashi et al. teach of lithium secondary batteries, wherein the capacity reaches 850 mAh/cm³ (indicating that the design must be at least that high to achieve such values) (para 0150). The motivation for designing secondary batteries with high capacity is in order to make it practicable to be used in portable electronics (para 0004-0005). Therefore it would have been obvious to one having ordinary skill in the art at

the time the claimed invention was made to design batteries with a high capacity design (for example such as 850 mAh/cm³) in order to make them usable in portable electronics.

As to claim 4, Miyasaka embodies three specific separator materials, one of which is polypropylene (col. 9, lines 62-66). It is noted that polypropylene material is specifically embodied within the example (col. 12, lines 29-31). Accordingly, Miyasaka at the very least render obvious the use of polypropylene as the material for the separator. (It is reiterated that as set forth in claim 1, part (a), it would have been obvious to substitute the type of separator – i.e. non-woven for the film – within the given example. Accordingly, the combination as made and applied to the specific example above would yield a non-woven polypropylene separator, further rendering obvious the material.)

8. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miyasaka in view of Nakamizo, Shi and Akashi et al. as applied to claim 1 above, and further in view of US 2002/0037450 (Suzuki et al.).

Miyasaka teaches binder materials for the protective layer. Such binder materials are the same as the ones used for the positive electrode materials, wherein carboxymethyl cellulose (CMC) is specifically appreciated (col. 7, lines 18-25). It is specifically noted more materials (wherein CMC is included) are exemplified in col. 8, lines 33-40). Miyasaka does not specifically teach of a binder having an acrylonitrile group.

However, Suzuki et al. specifically teach of a binder material used in the positive electrode of a lithium battery (para 0024). Specifically, the binder used is a combination of 2-ethylhexylacrylate, acrylic acid, and acrylonitrile (para 0031). The motivation for using such a binder is in order to have a binder that does not require heating to work and contains no water, in order to have a binder that is flexible but still maintains its form, and in order to provide a binder with the correct amount of stickiness and elasticity in order to prevent binder deterioration as well as to ensure strength (para 0031-0033). Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to use the binder taught by Suzuki et al. (containing acrylonitrile) as the binder in the protective layer of Miyasaka (instead of CMC), in order to provide a binder that would be simple to use (as it does not require heat and does not have extraneous water) and in order to impart a better binder with the right amount of stickiness and elasticity (which ensures that the binder is not deteriorated and ensures proper imparting of strength to the layer). (It is again noted that Miyasaka teaches that the binder used in the protective layer is the same as that used in a positive electrode, and thus such a teaching is combinable.)

Response to Arguments

9. Applicant's arguments filed August 13, 2010 have been fully considered but they are not persuasive.

Applicant argues that the cited prior art does not teach a thick non-woven fabric with a thickness of 15-25 μm .

Examiner respectfully disagrees. It is submitted that Applicant is merely making conclusory statements without providing any proof or reasoning. The thin non-woven film has been rendered obvious, as set in the rejection. For non-limiting example, how does Miyasaka (in combination with Nakamizo) not render such a limitation obvious? Miyasaka recognizes the use of both woven and non-woven separators, wherein the dimension is given. It is uncertain how the recognition of a non-woven option and a thickness does not render it obvious (especially in light of Nakamizo which provides further motivation to use the non-woven version). How is this limitation not obvious, over the rejection wherein Yamashita et al. is relied upon as the primary reference – a similar limitation was present in the claims as originally filed, wherein the Board upheld a similar rejection. According the arguments are not found to be persuasive, and the rejection of record is maintained.

Applicant argues that the design capacity density of 114 mAh/cm^3 is linked to a 18650 battery, and states that comparative example 1 shows that one would not use a non-woven fabric separator with a thickness of 15-25 μm .

Examiner respectfully disagrees with Applicant's position. First it is submitted that the design capacity density is not found anywhere in the specification, nor is a link between it and a cylindrical 18650 battery. Accordingly, such a limitation is new matter. Furthermore, such a recitation is merely in the preamble. In response to applicant's arguments, the recitation of having a design capacity density of 114 mAh/cm^3 has not been given patentable weight because the recitation occurs in the preamble (in one interpretation). A preamble is generally not accorded any patentable weight where it

merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). However it is noted that another interpretation was taken on the claim language, wherein it was afforded weight, but Akashi et al. is further relied upon to render design capacity density obvious. Lastly, with respect to the non-woven fabric separator, it is submitted that such is irrelevant - as it has not been linked to the capacity and does not correspond to any of the prior art rejections (as none of the prior art rejections have a single layered separator). According the arguments are not found to be persuasive, and the rejection of record is maintained.

Applicant makes a blanket statement that their claimed invention (having the claimed thicknesses) all have a battery capacity of 1890 mAH or more, equating it to 114 mAh/cm³ and then further comments about the amount of filler added.

Examiner is unsure what Applicant is trying to accomplish with such a remark. First, it is unclear how to draw capacity (units mAh) to capacity density (units mAh/cm³). Accordingly, it is unsure how the two values were equated. Furthermore, it is noted that batteries that fall outside the claimed range (for example battery 9, wherein the thickness of the fabric is 10 µm, below the claimed range, and the total thickness if 15 µm, also below the claimed range) still exhibit a capacity of greater than 1890 mAh. This shows that there is no criticality associated with the claimed thickness ranges. Lastly, it is submitted that there is no argument as to how the rejection of record does

not render such limitations obvious. According the arguments are not found to be persuasive, and the rejection of record is maintained.

Applicant argues that Yamashita's volume efficiency is unknown.

Examiner respectfully disagrees. It is submitted, as set forth above, such a limitation is only the preamble and thus is not afforded patentable weight. Additionally, if it was, Akashi et al. renders obvious wanting to increase volumetric capacity. Lastly, it is submitted that Applicant's own application does not clearly appreciate volume efficiency. According the arguments are not found to be persuasive, and the rejection of record is maintained.

Applicant argues that Yamashita and Miyasaka use negative electrodes made of alloys, which short circuit greatly and that one of ordinary skill in the art would not be likely to use a non-woven fabric with an alloyed negative electrode.

Examiner respectfully disagrees. Again, Applicant is making conclusory statements without providing proof or reasoning as to its validity. Thus it cannot be found to be persuasive. Additionally, it is noted that Miyasaka specifically states that a non-woven sheet can be employed as the separator (col. 9, line 61-65). Accordingly it is unsure as to how one of ordinary skill in the art would not found it obvious to use such a non-woven sheet in the battery of Miyasaka. According the arguments are not found to be persuasive, and the rejection of record is maintained.

Applicant (again) argues that that criticality to the claimed invention has been shown and again states that (I) Comparative Example 4 (PE microporous film with a porous film), example 5 (polypropylene non-woven fabric with a porous film), and

example 24 (polypropylene-polyamide nonwoven fabric with a porous film), pointing to how Examples 5 and 24 they have a significantly higher discharge capacity, capacity retention, and better nail safety data than Comparative Example 4 and (II) Comparative Example 2 (microporous film and no porous film), comparing it to Comparative Example 4, stating that the porous film leads to inferior charging characteristics with a microporous film, whereas the Examples show that the combination of a porous film with a non-woven fabric yields superior characteristics (discharge, defective, safety).

Examiner respectfully disagrees. With respect to both (I) and (II), it is submitted that such arguments were presented in the Appeal, and they were answered fully (see Issue 1(b) in the Examiner Answer dated 8/1/08). Furthermore, it is submitted that the Board upheld the Examiner's rejection and stated: "Appellants have not provided sufficient evidence of superior unexpected results" (see the last paragraph of p8 of the Board decision dated 8/19/09). Previously presented data that were found (by both the Examiner and the Board) to be insufficient to show unexpected results cannot be found to be convincing to provide unexpected results at this point. Applicant has not provided any further proof (beyond the data present in the Appeal), and thus it is submitted that no unexpected results have been shown.

With respect to arguments (I) and (II) separately, the corresponding portion of the response to Issue 1(b) in the Examiner's Answer is reiterated herein for clarity's sake with respect to the fact that no unexpected results have been shown.

" With respect to (I), Examiner submits that no unexpected/significant difference has been shown.

Regarding discharge capacity: Comparing the discharge capacity at 400 mA, comparative example 4 has a discharge capacity of 2008 mAh, whereas as examples 5 and 24 have discharge capacities of 2012 and 2011 mAh, respectively. This difference - merely 3 or 4 out of thousands of mAh - is not seen be significant. Additionally the discharge capacity at 4000 mA is not seen as significant either. Comparative example 4 has a discharge capacity 1789 mAh, while examples 5 and 24 have discharge capacities of 1821 and 1889 mAh, respectively. The greatest difference cited is 100 mAh (between example 24 and comparative example 4) out about 2000, wherein the difference is small compared to the fact that the scale is close to that of 2000 mAh. Additionally, it is noted that the design capacities of examples 5 (2015 mAh) and 24 (2015 mAh) are higher than that of comparative example 4 (2010 mAh), so one would expect the charge/discharge characteristics to yield higher numbers, as it is designed to be able to have higher capacities. Therefore, the comparisons of example 5, example 24, and comparative example 4 are not equal, as not all variables are the same at the time of the test. Such a comparison would be similar to comparing the discharge capacity of comparative example 4 to example 15, which has a design capacity of 1380, and drawing conclusions from it, wherein the design of the battery, besides what Appellant claims provides unexpected results, is different. Additionally, Examiner relies upon other examples in table 2 (not specifically cited by Appellant) to confirm the position that the differences in capacity is not significant and fails to show unexpected results. Some examples

that embody Appellant's claimed application have *lower* charge/discharge capacities than that of comparative example 4, even when the design capacity is higher. Examiner points to examples 16 and 17; example 16 has a design capacity of 2017 mAh, a discharge capacity of 1822 mAh at 400 mA and a discharge capacity of 1472 mAh at 4000 mA. This is either proof that (a) the discharge capacities between example 5, example 24, and comparative example 4 are not significantly different (as examples 16 and 17 and examples 5 and 24 embody a range that encompasses the results obtained by comparative example 4) or (b) that the results of the claimed invention are not necessarily superior to that of the prior art. Either way, Appellant's data fails to show unexpected results.

Regarding the capacity retention rate (%) after 300 cycles: Comparing comparative example 4 yields a retention rate of 88, while example 5 yields a retention rate of 95, and example 24 yields a retention rate of 93. However, the difference between a few percentages is not seen as significant. Appellant's table 2 shows such a trend. The highest retention rate is 95 (as displayed in examples 4 and 5), while the lowest retention rate is 91 (as displayed in examples 15 and 22). The difference in this is 4. The difference between comparative example 4 (88) and that of a retention rate obtained by the instant application as displayed in examples 15 and 22 (91) is 3. Therefore, it is seen that the difference between an embodied example and a comparative example is not terribly significant. Furthermore, by noting examples 5 and 24, Appellant is

only comparing the examples with the best characteristics, which does not appropriately represent the full scope of the claims. Furthermore, Examiner would like to note the fact that a non-woven cloth separator yielding higher capacity retention is not unexpected. Appellant's own background (admitted prior art) cites the fact that microporous film separators (i.e. that used in comparative example 4) has low porosity and thus has a low ability to retain electrolyte, especially after repeated charges and discharges, and thus capacity tends to be lower due to electrolyte depletion (para 0004). Appellant's admitted prior art further goes on to state that non-woven fabric retains electrolyte better than microporous film separators (para 0005). (Better electrolyte retention, as achieved by non-woven fabric) would result in higher capacity, as para 0004 of Appellant's admitted prior art states low electrolyte retention/electrolyte depletion, a characteristic of microporous films, results in lower capacity.) In addition to Appellant's admitted prior art, Examiner would like to introduce US 2001/0004502 (Nakamizo et al.) as an evidentiary piece further emphasize that the portion relied upon in Appellant's admitted prior art was known to one of ordinary skill in the art. Nakamizo et al. shows that it was known that microporous films (polyolefin resins as embodied by both the instant application and that of the prior art of Yamashita et al.) is known to have a low-electrolyte retaining characteristic due to only being able to hold electrolyte in the vacant holes (low porosity) and that non-woven fabrics improve the electrolyte retaining nature (para 0006-0008). Therefore Nakamizo et al. shows that low electrolyte

retention (corresponding to a low capacity) was a known problem within microporous films and that high electrolyte retention (corresponding to a high capacity), much like Appellant's admitted prior art. Therefore, Examiner is unsure how showing that a microporous separator has lower capacity retention is unexpected in light of the teaching in the admitted prior art and as evidenced by Nakamizo et al.

Regarding the nail penetration safety: Comparing examples 5 and 24 to comparative example 4 shows that the temperatures obtained by the tests are different. However, this is not a showing of unexpected, superior results. The data points given for example 5 are 74, 94, 72, and 89 °C. The data points given example 24 is 65, 93, 72, and 95 °C. The data points given for comparative example 4 are 80, 149, 77, and 91 °C. The temperatures for the first, third, and forth points are relatively similar (with comparative example 4 testing better at the fourth point – nail speed of 180 mm/s after 90s). However, Appellant fails to represent the full scope of the claims with the above comparison. For example, example 2 has nail penetration safety data wherein the first three data points are similar to that of comparative example 4 and the fourth point (at a speed of 180 mm/s after 90 s) is much worse: 78, 139, 77, and 136 °C. With this example present, Examiner is unsure how Appellant's claimed invention truly is shown to have superior results. Additionally, Examiner would like to note that the comparisons of comparative example 4 and the examples are not commensurate in scope. It is shown that the examples use a separator *material* (not just

separator type (non-woven cloth/microporous film)). In table 1, it can be seen that PP (polypropylene) non-woven cloth is embodied in most of the examples with one example using a PP-PA (polypropylene-polyamide) non-woven fabric. The separator of comparative example 4 is PE (polyethylene). Therefore, the materials being compared are different, and different materials have different characteristics (i.e. it is seen that the meltdown temperature of PE is lower than that of the tested PP and PP-PA). Therefore, the examples fail to show that it is really the material type (non-woven cloth/microporous film) and not the material itself (PP or PP-PA vs. PE) that provides these differences, as there is no example showing the use of a PE non-woven cloth separator.

With respect to (II), Examiner respectfully disagrees with Appellant's submissions.

Regarding the comparison of comparative example 2 and comparative example 4: Examiner respectfully disagrees that a separator made with a combination of a porous film with a microporous layer (comparative example 4) leads to inferior qualities than that of a microporous layer alone. For example, the design capacity of comparative example 2 is higher than that of comparative example 4 (2015 mAh vs. 2010 mAh). However, the comparative example 4 yields a slightly higher charge/discharge capacity at 400 mA (2008 vs. 2003 mAh). Although at 4000 mA, comparative example 2 is higher (1888 mAh) than that of comparative example 4 (1789 mAh), the difference cited is less than 100 mAh out about 2000 mAh, wherein the difference is small compared to the fact

that the scale is close to that of 2,000 mAh. It is noted that the capacity retention rate is nearly the same, too (90 for comparative example 2 and 88 for comparative example 4). Examiner submits that such differences in example 2 and 4 are not significant with respect to the capacity. Additionally, Examiner submits that Appellant has ignored part of the results. Nail penetration safety was much greater for that of comparative example 4 (with the porous sheet). The temperatures read at 1s for each of the nail speeds of comparative example 2 is much higher than that of comparative example 4 (see table 2). It is noted that no data was available for either nail speed at 90s. Along the lines of the examination of the data above, Examiner is unsure how comparative example 2 yields better characteristics overall than that of comparative example 4. Examiner would like particularly point out that the inclusion of a porous layer to a non-woven cloth yields similar trends as that of adding a porous film to a microporous film, and accordingly it is incorrect to conclude that the combination of porous film and yields inferior charging characteristics when the combination of a porous film with a non-woven cloth separator yields the same trends. Such analysis is provided herein. Looking at comparative example 1 (non-woven cloth separator) and comparative example 19 (non-woven cloth separator with porous layer), the data can be compared. The only difference is the addition of the porous layer. The design capacities are the same (2017 mAh). However, the charge/discharge characteristics of comparative example 1 are better than that of example 1 (in the same sense that comparative example 2 is better than

comparative example 4, wherein the only difference is the inclusion of a porous film in comparative example 4). Comparative example 1 has a discharge capacity 2012 mAh, while example 19 has a discharge capacity of 2015 mAh (nearly the same on a scale of over 2000 mAh) at 400 mA. However at 4000 mA, comparative example 1 yields a discharge capacity of 1971 mAh, while example 20 yields a discharge capacity of 1983 mAh. It is also noted that the capacity retention of comparative example 1 is higher than that of example 19 (95 vs. 94). Therefore, the inclusion of a porous layer in a battery with a non-woven cloth actually yields relationships with respect to capacity similar to that of the inclusion of a porous layer in a battery with a microporous film separator (i.e. having a porous layer in both a non-woven fabric separator as well as a microporous film separator has a higher discharge capacity at 400 mA, a lower capacity at 4000 mA, and a lower capacity retention rate when compared to its counterpart having no porous layer; please see table 2, comparative example 1 and example 19 and comparative example 2 and comparative example 4). Therefore, Examiner submits that that Appellant's judgment that the combination of PE film and porous film results in an inferior charging characteristics is misguided, as the inclusion of the porous layer yields the same capacity trends when added that of a non-woven cloth separator.

Regarding the statement that that the combination of a non-woven fabric and a porous film (example 5 and example 24) provides superior characteristics in all areas over batteries having no porous film, or a porous film combined with

PE: Examiner respectfully disagrees. The comparison between comparative example 4 and examples 5 and 24 have already been drawn in the response denoted under section (I), as seen above. For the reasons stated in section (I), Examiner submits that no unexpected and superior characteristics have been clearly shown. Examiner would like to submit that the prior art relied upon includes a porous layer, and thus comparative example 2 is not an appropriate comparison to make to show unexpected results with respect to Appellant's claimed invention and the prior art. Accordingly, Examiner submits (for the reasons set forth above in Issue 1(b)), that Appellant's fails to clearly set forth that their invention displays unexpected, superior characteristics.

Finally, Examiner would like to note that Appellant has not shown unexpected results as is deemed by the scope of the claimed invention. The separator is a "non-woven fabric" and the porous film is an "inorganic oxide filler with a binder." However, only two types of non-woven clothes are tested (PP and PP-PA). Appellant fails to test other cloths (such as polyamide alone, polyimide, polyethylene terephthalate (as indicated in claim 4), or other known separator materials such as polyethylene (as embodied in the prior art) as a cloth). Additionally, Appellant only tests two type of organic binders (alumina and titania) without testing other known inorganic oxides (such as zirconia or silica) and thus fails to appreciate the range of materials appreciated by the broad claim 1. By only testing a few materials, no position can be made that it is the combination of an inorganic oxide porous layer and a non-woven fabric that

provides what Appellant submits is superior and unexpected results, and such results may be consequences of the materials alone (i.e. a porous film with a PP non-woven fabric may have better nail safety penetrations than a porous film with a PE fabric only because the material has a higher melting point, as seen on table 1). Therefore, for the reasons set forth above and within subsections (I) and (II), Examiner submits that Appellant has not shown the fact that the combination of a non-woven cloth and porous film shows unexpected results."

It is noted that example 5 and 25 have been used in comparison to exemplify the claimed invention.

Accordingly such arguments are not found to be persuasive, and the rejection of record is maintained.

With respect to the arguments regarding the 103 rejections, Applicant argues that the prior art used to obviate the rejected claims (Fujiwara, Nakamizo, Shi) do not cure the deficiencies of the primary references (Yamashita and Miyasaka, separately). Applicant does not argue how the combination is not proper. Therefore, the Examiner maintains the obviousness rejections and upholds the rejection of the primary reference, as above.

Applicant argues that the prior art rejections do not teach the claimed invention (the limitations recited in the claimed omitted for brevity's sake).

Examiner respectfully disagrees. The rejection as well as response to Applicant's arguments clearly show that the claimed limitation have been met (wherein at this point Applicant has not particularly pointed out any limitation not addressed in the

remarks above that have not been addressed). Accordingly, Examiner submits all claim limitations have been met. Applicant appears only to argue the same points that were discussed on appeal (wherein the Board affirmed Examiner's rejection as well as the fact that the data provided does not show unexpected results) and to add new matter in attempts to overcome the rejection. As Applicant has not provided new data and has not clearly shown how the rejection of record does not render obvious the claimed invention, such arguments are not found to be persuasive, and the rejection of record is maintained.

Applicant argues that the dependent claims are distinct from the prior art of record for the same reason as the independent claim.

Examiner respectfully disagrees. The rejection with respect to the independent claim has been maintained, and thus the rejections to the dependent claims are maintained as well.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EUGENIA WANG whose telephone number is (571)272-4942. The examiner can normally be reached on a flex schedule, generally 6 - 3:30 Mon. - Thurs., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/E. W./
Examiner, Art Unit 1726

/Gregg Cantelmo/
Primary Examiner, Art Unit 1726